

Borehole

# 51-03-11

Log Event A

## Borehole Information

Farm : <u>TX</u>	Tank : <u>TX-103</u>	Site Number : <u>299-W15-191</u>
N-Coord : <u>41,692</u>	W-Coord : <u>75,965</u>	TOC Elevation : <u>670.00</u>
Water Level, ft :	Date Drilled : <u>5/31/1977</u>	

## Casing Record

Type : <u>Steel-welded</u>	Thickness : <u>0.280</u>	ID, in. : <u>6</u>
Top Depth, ft. : <u>0</u>	Bottom Depth, ft. : <u>100</u>	

## Borehole Notes:

This borehole was completed in May 1977 to a depth of 100 ft. The borehole was started with 8-in. casing, which was driven to an unknown depth, and then drilled to a depth of 105 ft with 6-in. casing. The bottom 5 ft of the borehole was cemented. The 8-in. starter casing was removed, and the annulus between the permanent 6-in. casing and the borehole wall was filled with concrete grout.

The casing thickness is presumed to be 0.280 in., on the basis of published thickness for schedule-40, 6-in. steel tubing.

The top of the casing is the starting depth for the logs. The casing collar is about even with the ground surface.

## Equipment Information

Logging System : <u>2</u>	Detector Type : <u>HPGe</u>	Detector Efficiency: <u>35.0 %</u>
Calibration Date : <u>10/1995</u>	Calibration Reference : <u>GJPO-HAN-3</u>	Logging Procedure : <u>P-GJPO-1783</u>

## Log Run Information

Log Run Number : <u>1</u>	Log Run Date : <u>12/20/1995</u>	Logging Engineer: <u>Alan Pearson</u>
Start Depth, ft.: <u>99.5</u>	Counting Time, sec.: <u>100</u>	L/R : <u>L</u> Shield : <u>N</u>
Finish Depth, ft. : <u>10.0</u>	MSA Interval, ft. : <u>0.5</u>	Log Speed, ft/min.: <u>n/a</u>

Log Run Number : <u>2</u>	Log Run Date : <u>12/21/1995</u>	Logging Engineer: <u>Alan Pearson</u>
Start Depth, ft.: <u>99.5</u>	Counting Time, sec.: <u>100</u>	L/R : <u>L</u> Shield : <u>N</u>
Finish Depth, ft. : <u>4.0</u>	MSA Interval, ft. : <u>0.5</u>	Log Speed, ft/min.: <u>n/a</u>

Log Run Number : <u>3</u>	Log Run Date : <u>12/22/1995</u>	Logging Engineer: <u>Alan Pearson</u>
Start Depth, ft.: <u>0.0</u>	Counting Time, sec.: <u>100</u>	L/R : <u>L</u> Shield : <u>N</u>
Finish Depth, ft. : <u>5.0</u>	MSA Interval, ft. : <u>0.5</u>	Log Speed, ft/min.: <u>n/a</u>

Borehole

**51-03-11****Log Event A**

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**Analysis Information**

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Analyst : H.D. Mac LeanData Processing Reference : P-GJPO-1787Analysis Date : 9/17/1996**Analysis Notes :**

This borehole was logged by the SGLS in three logging runs. Data from the first log run were lost as a result of a computer failure. Acceptable data were obtained from a repeat of the first log run.

The pre- and post-survey field verification spectra met the acceptance criteria established for the peak shape and system efficiency, confirming the SGLS system was operating within specifications. The energy calibration and peak-shape calibration from these verification spectra were used to establish the channel-to-energy parameters used in processing the spectra acquired during the logging operation.

Casing correction factors for a 0.280-in.-thick steel casing were applied during analysis.

A depth overlap, where data were collected by separate runs at the same depth, occurred in this borehole between depths of 4 and 5 ft. The concentrations of Cs-137 and the naturally occurring gamma-ray-emitting radionuclides calculated using the separate data sets at the overlapping depth points were within the statistical uncertainty of the measurements, indicating very good repeatability of the radionuclide concentration measurements.

The man-made radionuclides Cs-137, Co-60, Eu-154, and Eu-152 were identified in this borehole. The Cs-137 occurs mainly within the upper 23 ft of the borehole; Cs-137 is frequently encountered in this depth interval in other monitoring boreholes. The Co-60, Eu-154, and Eu-152 contaminants were encountered within sediments below the base of the tank farm at a depth of approximately 51 ft below the surface. The Eu-154 contaminants occur in a zone that extends for about 9 ft below the contact, between depths of 51 and 60 ft.

The presence of Cs-137 was noted continuously from the ground surface to a depth of 23 ft. The maximum Cs-137 concentration in this continuous zone (about 25 pCi/g) occurs at a depth of 1 ft below the surface. The concentrations of Cs-137 throughout the remainder of this contaminated zone are generally about 2 to 3 pCi/g, with a minor peak (concentration of about 6 pCi/g) occurring between depths of 15 and 15.5 ft. Cs-137 occurs in concentrations of about 1 pCi/g between depths of 69 and 74.5 ft and in concentrations below 1 pCi/g between depths of 75 and 81.5 ft.

Significant Co-60 contamination (concentrations ranging from above 100 pCi/g to about 10 pCi/g) occurs between the previously referenced contact and a depth of 68.5 ft. Co-60 was also detected intermittently between 68.5 ft and the bottom of the borehole. A zone of slightly elevated Co-60 contamination (concentrations between 1 and 2 pCi/g) occurs between depths of 89 and 95 ft. Below 95 ft, Co-60 concentrations are less than 1 pCi/g.

The presence of Co-60 is indicated by both the 1173- and 1332-keV spectral peaks. The presence of Eu-154 is indicated by the spectral peak at 1274 keV, and confirmed by spectral peaks at 1004, 873, 723, and 123 keV. Although the calculated Eu-152 concentration at the 53-ft depth is close to the MDL, a distinctive 121-keV energy peak occurs in the spectrum acquired at that depth. The identification of Eu-152 is supported by the identification of Eu-152 in the adjacent boreholes 51-07-18 and 51-07-07.

Borehole

**51-03-11****Log Event A**

A compilation of gross count gamma-ray logs acquired between June 1982 and June 1994 and the SGLS total count log acquired in December 1995 shows a zone of anomalous radiometric activity in the depth interval between approximately 51 and 68 ft that corresponds to the zone of Co-60 and Eu-154 contamination. The earliest log in the compilation indicates a zone of anomalous radiometric activity between depths of 54 and 60 ft. The gamma-ray intensity in the upper portion of this activity zone decreased between 1982 and 1986, but increased between 1986 and 1990. By 1994, the zone had increased in thickness to about 20 ft, but the intensity of the gamma-ray activity decreased.

The decrease below background in the K-40 concentration between depths of about 8 and 14 ft probably reflects attenuation of the gamma-ray energy associated with the K-40 radionuclide by the grout emplaced as the 8-in. starter casing was withdrawn. Although a 20-ft length of starter casing is normally used when drilling these boreholes, the log of the K-40 concentration indicates the presence of grout to a depth of only 14 ft. Where present, the grout will also attenuate the gamma-ray energy from Cs-137 and other radionuclides of interest; accordingly, the calculated Cs-137 concentrations in the interval where grout may be present may be understated because corrections have not been made for the unknown thickness of grout that may be present in this region of the borehole.

A steplike increase in the measured K-40 concentration (from about 10 to about 15 pCi/g) occurs at a depth of 49 ft. There is a small change in the K-40 background concentration between depths of 18 and 24 ft.

Additional information and interpretations of log data are included in the main body of the TSDR for tank TX-103.

**Log Plot Notes:**

Separate log plots show the man-made radionuclides (Cs-137, Co-60, and Eu-154) and the naturally occurring radionuclides (KUT). The natural radionuclides can be used for lithology interpretations. The headings of the plots identify the specific gamma rays used to calculate the concentrations.

A combination plot includes both the man-made and natural radionuclides, in addition to the total gamma derived from the spectral data and the Tank Farm gross gamma log. The gross gamma plot displays the latest available digital data. No attempt has been made to adjust the depths of the gross gamma logs to coincide with the SGLS data.

Uncertainty bars on the plots show the statistical uncertainties for the measurements as 95-percent confidence intervals. Open circles on the plots give the MDL. The MDL of a radionuclide represents the lowest concentration at which positive identification of a gamma-ray peak is statistically defensible.

A compilation of representative historical gross gamma-ray logs, selected from available digital data sets at approximately 3-year intervals starting in June 1982, and the SGLS total count log are included.